

# The Berman Foreign-Body Locator

J. P. McBRIDE, M.D., *Los Angeles*

THE Berman Foreign-Body Locator, developed by Samuel Berman, an electrical engineer, and J. J. Moorhead, both of New York City, is proving valuable as a supplement to the present indispensable methods of x-ray and fluoroscopy location of metallic foreign bodies embedded in tissues. Although it is well known that in many cases, foreign bodies, if they cause no symptoms, do not necessitate operation, removal of those that interfere with normal function usually is required. The surgeon, however, has undertaken the removal of such bodies from the deeper structures with reluctance, because of the difficulties involved in their detection and actual location on the operating table. Experience is proving the Berman locator to be especially helpful with all magnetic foreign bodies, except those which are extremely small. Its usefulness is also limited with large non-magnetic objects.\*

The Berman locator, first used successfully in 1941, utilizes electronic principles to determine the location of metallic foreign bodies embedded in tissues. It is equipped with a meter on the control panel to indicate when a metallic body is near, and also with a horn that sounds with increasing intensity as the object is approached. The handling of the machine is simple, and it can be tuned properly and set in operation in only a few minutes.

A review of the literature is convincing that the Berman locator is a valuable adjunct to present methods. Parks<sup>4</sup> reports a case of a foreign body just proximal to the metacarpal phalangeal joint of the thumb. Although the locator led him to a point just over the extensor tendon, Dr. Parks, who had not previously used the machine, hesitated to incise the tendon sheath, for he could see no evidence of the foreign body. He called Mr. Berman for advice, and at his suggestion incised the tendon as the probe indicated. A small metallic body was easily removed.

Moorhead<sup>3</sup> records the removal of a small foreign body from the deltoid region after two previous attempts, without the help of the Berman locator, had failed. In another case a needle was removed from the left ventricle with the aid of the locator.

Skiles<sup>6</sup> reports two cases: In one a broken spinal syringe needle in the back was removed in 15 minutes with a minimum of trauma. In the second case a needle was embedded posterior to the patellar tendon. It was removed with little difficulty through the use of the locator.

Rieger<sup>5</sup> recounts a case in which a broken hypodermic needle deep in the pterygoid muscles was removed with the help of the Berman after a previous attempt without the locator had failed.

Minsky<sup>2</sup> and Alvis<sup>1</sup> report several cases in which intraocular foreign bodies were located with the assistance of the Berman locator, and removed.

In addition, this instrument has been found useful in connection with foreign bodies in the thorax, the abdomen, the neck, the brain, and the perineum.

The author's own experience with the Berman locator is confined to use in searching for foreign bodies in and about the structures of the eye. Although x-ray location of intraocular foreign bodies by the Sweet and Comberg methods has proved very satisfactory, it is not uncommon for x-ray to be in error a few millimeters in the exact location of such bodies. The following case report illustrates the usefulness of the Berman locator:

## CASE REPORT

CASE 1.—The patient, while pounding a king-pin with a hammer, received a penetrating wound in the right eye. Examination showed a tiny corneal wound, 5 o'clock midway, an iris window, and an opaque lens. A roentgenogram, which located a metallic body 1x2x2.5 mm., 18 mm. back of the center of the cornea, 2 mm. below the horizontal plane, and 2 mm. to the temporal side of the vertical, placed the object in the posterior vitreous. At operation the lower temporal quadrant of the sclera was exposed. The Berman locator probe was applied to the sclera with no response. Then the magnet was applied to the exposed sclera for about one minute. Again the probe of the Berman instrument was employed, and a signal was obtained, indicating that the fragment was immediately under the sclera about 9 mm. from the limbus. An incision was made in the sclera with the graefe knife and the foreign body removed with the first application of the magnet to the incision.

Although it is likely that this foreign body could have been removed without the aid of the Berman locator, perhaps less trauma resulted than would have been caused by the usual method of making a scleral incision as near the foreign body as possible and depending on the magnet to pull it to the incision. When a foreign element is far back in the vitreous, one is at a loss to determine the exact site for making the scleral incision. In the case reported, it was gratifying that the splinter was immediately under the sclera as the instrument indicated.

## CASE REPORT

CASE 2.—The patient had received a small penetrating wound over the ciliary body 4 mm. from the limbus, temporal side, right eye. The media of the eye were clear and no evidence of a foreign body was visible. When the Berman probe was applied to the globe in the wound area, the height of the response was noted directly over the wound. This indicated that a foreign body, probably magnetic, was in the eye in the region of the wound. The magnet was applied over the area, its pull being directed away from the lens, and a foreign body measuring 3x2x1 mm. was removed.

Again this fragment could have been removed without the Berman locator. However, knowledge

\*The biplane fluoroscope developed by Leishman may also prove to be an additional aid in exact location at the time of operation.

given by the instrument that the foreign body was in the region of the wound was valuable; for a foreign body near the ciliary can damage the lens if pulled into it by the magnet, and save for the information given by the instrument, the operator would have hesitated to apply the magnet blindly without x-ray location.

#### CASE REPORT

CASE 3.—The patient had received a penetrating wound of the right eyelid. X-ray located a foreign body measuring 3x3x5 mm. in the upper nasal aspect of the right orbit posterior to the trochlea. The globe was not injured, and the wound healed with first intention. For 30 days the patient complained of pain about the eye and insisted on having the splinter removed. With the magnet applied as indicated by the Berman locator, the small metallic body was dislodged without much difficulty.

Here again the operator would have been reluctant to attempt removal without the Berman locator.

Regarding the detection of foreign bodies of various sizes and compositions, the following paragraph from a bulletin by Berman says:

"The distance from which a magnetic foreign body will be detected depends upon its size and composition. Soft iron and ordinary 'carbon' steel are the most responsive. Alloy steels such as ball-bearing steel and 'high speed' tool steel are less responsive. Certain stainless steel alloys are entirely non-magnetic and will give no response.

"The following distances apply to common iron or carbon steel:

Dia. of Mass	Approximate distance of detection from bare element (shield removed)
1/4 mm.	2 1/2 mm.
1 mm.	10 mm.
3 mm.	30 mm.
Common steel needle	1 1/2 to 2 inches
3-inch iron nail	4 inches

"The sensitivity of the locator to non-magnetic metals (copper, brass, aluminum, lead, and so on) is relatively low and not always helpful. However, when a foreign body has been approached closely enough to be within detecting range of the probe and yet cannot be found, the locator can be most helpful.

"The following distances apply to non-magnetic metals:

0.45 caliber lead bullet	3/4 inch
0.22 caliber lead bullet	1/2 inch
copper one-cent piece	1 inch"

The limitations of the Berman locator with extremely small magnetic intraocular foreign bodies is illustrated in the next two cases.

#### CASE REPORT

CASE 4.—The patient had received a tiny corneal wound in his right eye, 9 o'clock at the limbus. There was a window in the iris behind, a clear lens, and a visible shiny metallic foreign body lying on the retina in the dependent portion of the globe. There was no hemorrhage in the vitreous. An x-ray was reported as showing the foreign body, 0.5x0.5x1 mm., in the area where it was visible. The sclera was exposed

in the midline below, and the inferior rectus was severed from the globe. The Berman probe gave no response, even after repeated applications. The magnet caused no sensation of pain. Yet the foreign body was clearly visible with the ophthalmoscope. Under direct vision the magnet was applied and the body noted to be magnetic, as it moved slightly with each application, though never out of its bed. A scleral incision was made within 2 mm. of the foreign body, but it could not be removed as it was apparently anchored securely to the sclera. For the next 30 days the eye was exposed daily to the giant magnet in an effort to increase the magnetism of the foreign body. After this period, another unsuccessful attempt was made to remove the fragment from the globe. The eye was lost. The Berman instrument proved to be of no value in this case, as a response was never elicited, even though the tip of the probe was within 1 mm. of a visibly magnetic foreign body.

By experimenting with foreign bodies of 1/2 mm. dimensions, the author has found that it is often necessary almost to touch the foreign body to obtain a response, which varies with the kind and size of the metal and its magnetism.

#### CASE REPORT

CASE 5.—The patient reported on the day of injury with a needle-like steel foreign body, measuring 0.5x0.5x4 mm., in the center of the vitreous, right eye. The media were clear and the fragment could be seen easily with the ophthalmoscope. The sclera was exposed and the Berman probe applied over a large area with no response. Under direct vision, the magnet was used and the foreign body was pulled to the lower temporal quadrant of the globe. Again the Berman probe was applied and a good response elicited. A scleral incision was made at the site of the greatest response, the magnet employed, and the foreign body easily removed. Upon healing, the eye was normal.

Experience in this case showed that it was necessary to bring the locator probe within 5 mm. of the object before gaining a response. This explains the lack of response when the foreign body was in the vitreous center.

#### CONCLUSIONS

The surgeon confronted with the removal of a metallic foreign body will do well to acquaint himself with the Berman Foreign-Body Locator, for it is a valuable adjunct to the present methods of location and removal.

1052 West 6th Street.

#### REFERENCES

1. Alvis, Bennett Y.: The use of the Berman Locator in removal of intraocular foreign body, *So. Med. J.*, 39:125-132, (Feb.), 1946.
2. Minsky, Henry: Transcleral removal of intraocular foreign body with aid of the Berman Locator, *Archives Ophthalmol.*, 31:207-210 (March), 1944.
3. Moorhead, J. J.: Foreign body finder, locator, *J.A.M.A.*, 121:123-125 (Jan. 9), 1943.
4. Parks, Morey: Use of foreign-body locator in industrial practice, *Am. J. of Surg.*, 65:3:373-380 (Sept.), 1944.
5. Rieger, Henry G.: Foreign-body locator in oral surgery, *J. Am. Dent. Ass.*, 32:1430-1431 (Nov. & Dec.), 1945.
6. Skiles, James H.: Removal of metallic bodies with the aid of a metal locator, *Am. J. Surg.*, 68:2:266-267 (May), 1945.